Ne and Xe in SiC from the Acfer 094 Meteorite. K. Kehm[1], X. Gao[1], C. M. Hohenberg[1], A. P. Meshik[1], P.D. Swan[1], and R. M. Walker[1] [1]McDonnell Center for Space Sciences, Washington University, St. Louis, MO 63130, (run@radon.wustl.edu).

Recent mineralogic, petrologic, and light element isotopic studies of the Saharan meteorite Acfer 094 indicate that it shares common properties with both CM2 and CO3's and may in fact represent a unique class of carbonaceous chondrites [1,2]. This primitive meteorite was also determined to carry presolar material. Stepped-combustion analysis of Acfer 094 indicated the presence of presolar SiC in bulk abundance of 28.7 ± 6.3 ppm [1]. Gao *et al.* [3] subsequently chemically separated SiC, as well as spinel, diamond, and graphite from Acfer 094. SEM-EDS/ionprobe measurements of the SiC/spinel residue confirmed the presence of presolar SiC in bulk abundances of 11-17 ppm [3], several times higher than the Murchison SiC concentration.

In the current study, we have measured the Ne and Xe contents in corresponding SiC/spinel separates from Acfer 094 prepared by Gao *et al.* As suggested by the work of Huss & Lewis [4], the relative concentration of presolar grains and their respective noble gas contents can provide insight into the nebular history of the host meteorite. This work represents the first noble gas measurements on Acfer 094.

SiC/spinel separates from Acfer 094 were prepared using the acid-dissolution techniques developed at the University of Chicago [5]. Material from two grain size separates, < 0.3 µm (hereafter referred to as 'A') and > 0.3-4 µm ('B'), were deposited into individual Pt boats and weighed (Table 1). The samples were subsequently loaded into the sample system of an all-metal, magnetic sector noble gas mass spectrometer. Each boat was step-heated in a W coil in increments of 100 to 200 C. Released gas was purified and analyzed for all five noble gases. Here we report the Ne and Xe data only.

Isotopic data for separates A and B are shown in Figs. 1 and 2. Within error, Xe is an exclusive mixture between normal Xe-P1 or Q-Xe [6], Murchison-like S-process Xe [7], and possibly a small Xe-HL contribution. Xe-HL, if present, is obviously not a dominant component (Fig. 1), indicating that the residue preparation succeeded in removing nearly all of the diamond from the SiC/spinel separate. In both size fractions, Ne consists of a mixture between cosmogenic Ne (here we assume the cosmogenic component derived by [4] for SiC/spinel separates), a distribution of isotopically normal planetary components, and Murchison-like Ne-E(H) [7]. The isotopically normal component is probably dominated by Ne-P1 or Q-Ne [6], with possibly small additional amounts of diamond-derived Ne-A1/A2. As expected, anomalous Ne-E(H) and Xe-S, consistently associated with meteoritic SiC, are present in the 1000-1500 C temperature steps in both residues.

Estimates of the Xe-S and Ne-E(H) contributions in these residues are calculated by deconvolving the isotopic data using the aforementioned components (Table 1). Ne-A1/A2 were excluded as endmember compositions since they are relatively isotopically similar to Ne-P1, and since diamond contributions to these residues are small. Gas concentrations are arrived at assuming that all the anomalous components are sited in SiC and using the wt.% SiC as measured by SEM/EDS for each residue [3]. Assuming an average of 13 wt.% SiC content in residue B, a mass-weighted gas concentration for Acfer 094's total SiC can be estimated. Xe-S and Ne-E(H) calculated by this method are ~6.6E-8 ccSTP/g and ~25E-6 ccSTP/g of SiC, respectively. For comparison, gas concentrations in Murchison KJ 'bulk' SiC for Xe-S and Ne-E(H) are 10E-8 ccSTP/g and 167E-6 ccSTP/g, respectively [7].

Thus, while Xe-S content in Acfer 094 SiC is comparable to that of Murchison, Ne-E(H) is ~6.6 times less abundant. While factors of 2 difference in these gas concentrations are conceivable considering possible systematic uncertainties in things such as our absolute spectrometer sensitivity and the wt.% SiC in the residues, larger discrepancies probably reflect fundamental differences between the SiC grain populations in Acfer 094 and Murchison.

Different SiC grain-size distributions in the two meteorites may be an important factor. Lewis *et al.* [7] measured general trends of increasing Ne-E(H) accompanied by decreasing Xe-S concentrations with increasing mean grain-size in Murchison. The distributions of equivalent spherical diameters for Acfer 094 SiC grains is sharply peaked at ~0.2 µm compared to ~0.4 µm for Murchison [3,5]. Unlike Murchison, Xe-S and Ne-E(H) both increase with grain size in Acfer 094 SiC. However, none of the K-series residues have grain sizes in a range directly comparable to the A residue from Acfer 094. On the other hand, gas concentrations and probably size distributions in residue B are similar to those in KJA, KJB and perhaps KJC from Murchison. Ne-E(H)/Xe-S ratios are also similar: ~340 in Murchison KJA and KJB SiC (0.38 µm and 0.49 µm mean diameters, respectively) [7], compared to ~500 for Acfer 094 residue B. Thus, the distinction between Murchison and Acfer 094 SiC gas concentrations is at least partly attributable to differences in SiC grain-size distributions, with Acfer 094 deriving a much larger fraction of its gas inventory from relatively fine-grained SiC.

This grain-size distinction also apparently extends to Murray, the only other CM2 for which Ne-E(H)/Xe-S has been measured [8]. SiC in Murray and Murchison have ratios of ~1100-1600 [7,8] while in Acfer 094 SiC, this ratio is a factor of 2 to 3 times lower (Table 1). However, SiC may be as much as 3 times more abundant in Acfer 094 than in Murchison [3]. It can therefore be argued that, to the extent that observed differences in grain size distributions reflect real differences in the indigenous SiC grain populations, Acfer 094 is fundamentally distinct from the CM2s having retained, either during accretion or as a result of parent-body processes, a finer-grained population of SiC. This difference is also reflected in the graphite abundance which is several orders of magnitude less in Acfer 094 than in Murchison [3]. Comparing with data obtained by Huss & Lewis [4] for

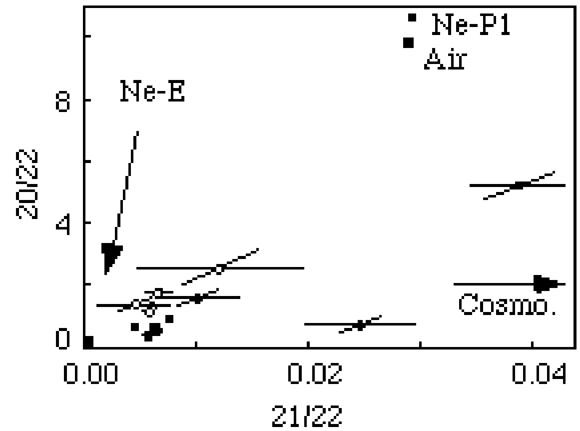
Ne and Xe in SiC from the Acfer 094 Meteorite. Kehm *et al.*

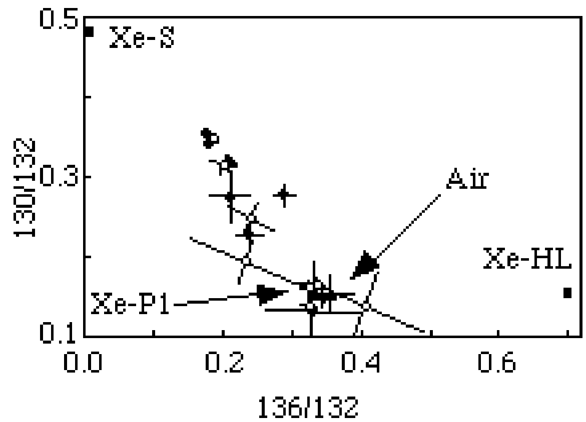
Kainsaz, a CO3, diamond abundances are at least similar, while the SiC abundance in Kainsaz as inferred by the noble gas concentrations is orders of magnitude lower than in Acfer 094. However, the reported Ne-E(H)/Xe-S ratio for Kainsaz has large error bars and it may be that, like Acfer 094, Kainsaz is dominated by fine-grained, gas-poor SiC. In either case, our measurements demonstrate that the SiC grain content in Acfer 094 is different than that in the CM2s, and might be similar to that found in the CO3 meteorite Kainsaz.

References. [1] J.A. Newton *et al.* (1995) *Meteoritics* **30**, 47-56; [2] A. Bischoff & T. Geiger (1994) *LPSC. XXV*, 115-116; [3] X. Gao *et al*. (1996) *Met. & Planet. Sci.* **31**, 48; [4] G.R. Huss & R.S. Lewis (1995) *GCA* **59**, 115-160; [5] S. Amari *et al.* (1994) *GCA* **58**, 459-470; [6] R. Wieler *et al*. (1992) *GCA* **56**, 2907-2921; [7] R.S. Lewis *et al*. (1994) *GCA* **58**, 471-494; [8] M. Tang & E. Anders (1988) *GCA* **52**, 1235-1244.

Table 1. The uncertainties in the absolute gas sensitivities are estimated at ~10%.

residue	wt.% SiC in residue	residue mass (μg)	132Xe-S E-8 ccSTP/g SiC	22Ne-E(H) E-6 ccSTP/g SiC	Ne-E(H)/Xe-S
A	100	3.0(0.7)	3.7(1.1)	6.2(1.4)	~150
B	6 to 20	20.3(0.7)	18.3(3.3) to 5.5(1.0)	91.7(3.3) to 27.5(1.0)	~500





Figures 1 and 2. Blank-corrected Xe and Ne data from size separate A (open circles) and B (filled circles) are plotted along with standard compositions, for reference.